

NASA SUSPENDED LOAD OPERATION INTERIM ANALYSIS/APPROVAL

1. OPERATION

Orbiter towing to the MDD after KSC landing. OMI 50028, SAA290M01-001

2. REQUESTOR Pete Wagner	ORGN. LO/OHE	PHONE 5388	DATE 9/18/92	REQUEST NO. SLO-KSC-1992-004
3. CONTRACTOR LSOC	4. CONTRACT NO. NAS 10-10900	5. VEHICLE/GSE/EFFECTIVITY FACILITY OV-102 / STS 52 / VAB		6. TIME PERIOD/DURATION
7. DOCUMENT GP 1098	8. TITLE KSC Ground Safety Plan, Vol 1			9. ITEM NO. Section 2.36
NSS/GO-1740.9	NASA Standard for Lift Devices and Equip			Para 2.7.18

10. REQUIREMENT

The two documents listed in block #7 do not allow personnel to work under suspended loads. The requirements are as follows:

GP 1098F-"A load will not be lifted, suspended, or transported over personnel..."

NSS/GO-1740.9-"Loads shall not be moved over people unless specifically authorized in a technical operating procedure."

11. DESCRIPTION

Allow personnel to be in the area of increased hazard directly under the suspended load for the operations involved in towing OV-105 Endeavor to the MDD from the KSC landing site for orbiter lightning protection. The orbiter is usually towed directly to the OPF after a KSC landing but all OPF bays are still occupied. See detailed description of the operation, including manloading requirements.

12. DETAILED RATIONALE

The operation detailed is performed under the supervision of a qualified and certified move director with NASA and SPC safety providing on-site support. Only the essential number of personnel required to perform the operation shall be working under the suspended load. The lifting equipment has current proof test and validation. All hoist operators have current certifications. The maximum number of people under the suspended load shall not exceed five (5) at any time.

13. REMARKS

14. REQUIRED APPROVAL

CONTRACTOR

☐ DESIGNS ☐ RACA
☐ OPERATIONS ☐ SAFETY

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☐ OPERATIONS ☐ SAFETY

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General Description:

This operation involves the towing of the orbiter to and from the Mate/Demate Device (MDD) at the Shuttle Landing Facility (SLF), Kennedy Space Center. The Orbiter is either towed to the Orbiter Processing Facility (OPF) or the Vehicle Assembly Building (VAB) to be readied for its next flight. A detailed engineering review and hazards analysis of this operation have been conducted. Due to the uniqueness of the activity and the limitations imposed when using present systems, hardware, and facilities, there remain some tasks where suspended load operations are required under specifically approved and controlled conditions. The orbiter tow to and from the MDD requires a minimum number of personnel under the load to perform the following task:

1. Orbiter tow/spot into/out of the MDD apron passing under the suspended H70-0743 Orbiter lifting sling (3 personnel-20 minutes).

RATIONALE/ANALYSIS: The suspended load tasks comply with the NASA Alternate Safety Standard as follows:

Alternate Standard Requirement #1a: Orbiter towing/spotting into and out of the MDD cannot be conducted without personnel beneath the suspended load. The tasks performed under the load have been analyzed and evaluated with the determination no feasible engineering design or procedural options are readily available to eliminate the suspended load operation.

Alternate Standard Requirement #1b: Secondary support systems to assume support of (catch) the load were evaluated and were not feasible for this operation. Design criteria is not available to prevent the sling from being a suspended load.

Alternate Standard Requirement #1c: The maximum number of personnel are identified for work to be performed under the suspended load for each task (Reference Description on page 2, Item 1). These personnel are also identified with safety vests to annotate the required personnel for the operation.

Alternate Standard Requirement #1d: Technicians will accomplish the required task as quickly and safely as possible to minimize time exposure (Reference Description on page 2, Item 1)

Alternate Standard Requirement #4: OMI S0028 has been revised to require only the minimum number of technicians to work under the suspended loads. The OMI is available on site for inspection during the operation.

Alternate Standard Requirement #6: The three 55 ton hoists at the MDD are designed, tested, inspected, maintained, and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9. These 55 ton hoists are designed to a minimum safety factor of 5 (based on the ultimate yield strength) for the hoist load-bearing components. The H70-0743 orbiter lifting sling is designed with a safety factor of 5 against ultimate strength and a safety factor of 3 against yield.

The hoists are equipped with two holding brakes and an emergency overspeed brake, each capable of holding the hoist rated capacity.

The hoists were one-time proofloaded at 125 percent of rated capacity, are load tested annually at 100 percent of rated capacity, and have a quarterly, semi annual, and annual preventive maintenance program to ensure proper operation.

The wire rope is inspected monthly for discrepancies. Nondestructive testing of the crane hook is performed annually.

When performing the towing operation, the H70-0743 orbiter lifting sling and two hoists are connected to the aft attach points. One hoist is connected to the orbiter forward attach points. The orbiter lifting sling weighs approximately 26,000 pounds which is within the rated capacity of the hoists.

Alternate Standard Requirement #7: Suspended load operations associated with orbiter towing involve the three 55 ton hoists at the MDD. A System Assurance Analysis (SAA290M01-001) has been completed on the system. The SAA includes a failure modes and effects analysis, critical item list (FMEA/CIL) and a hazard analysis. The SAA identifies no single failure points for the MDD 55 ton hoist. A copy of the SAA is on file at LSOC Safety-KSC, NASA Safety-KSC and NASA Safety-HQ for review.

Alternate Standard Requirement #8: Visual inspections for cracks or other signs of damage or anomalies are performed on the crane hook and lifting sling assembly with crane functional checks being performed prior to each operation per NSS/GO-1740.9.

Alternate Standard Requirement #9: The crane operators, emergency pendant operators and mechanical technicians are all trained and have current certifications. Operators will remain at the crane controls while personnel are under the load.

Alternate Standard Requirement #10: Appropriate safety clear areas are established and maintained prior to and during the operation. Only the minimum number of people will be permitted in this area.

Alternate Standard Requirement #11: A pretask briefing and a safety walkdown of the area are conducted prior to the tow to ensure all systems and personnel are ready to support. All participants are instructed on their specific tasks and are warned of the hazards involved. Following any crew change, new personnel are instructed by the task leader on their specific tasks and warned of the hazards involved.

Alternate Standard Requirement #12: Personnel beneath the suspended load will be in radio, visual and/or voice contact with the crane controller and/or signal person. Upon loss of communication, the operation shall stop immediately, personnel shall clear the hazardous area, and the load shall be safed. Operations shall not continue until communications are restored.

Alternate Standard Requirement #13: Ground controllers and E-stop operators are properly positioned during all phases of the lifting operation in full view of the load block, lifting fixtures and fixture attach points. One E-stop operator, remote from the crane operator's cab, can stop the crane if a failure indication is observed. Personnel working beneath the load shall remain in continuous sight of the operator and/or signal person.

APPROVAL:

DATE: SEP 18 1992

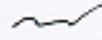
APPROVAL:

DATE:

| No Single Failure Points |
| Signature not required. |



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